In The Claims

Please amend the claims as follows:

1 Presently Amended

An ~~In an~~ apparatus for liquid-vapour separation processes, said apparatus comprising, in fluid communication, a closed system liquid distributor 24 and a liquid-vapour separation column 22 tiltable from the vertical, said liquid distributor 24 comprising a primary distribution zone 18 and at least one secondary distributor 10, said primary distribution zone 18 being in fluid communication with the or each secondary distributor 10 and the or each secondary distributor 10 having a plurality of liquid distribution apertures 36 providing said fluid communication between the liquid distributor 24 and the column 22,

wherein ~~the improvement consisting of~~:

(i) the distance between the two apertures that are furthest apart in the or each secondary distributor 10 (the "characteristic length") is such that the liquid distributor 24 provides, at each angle of tilt, a standard deviation of liquid flow rates through the apertures of the or each secondary distributor 10 that is less than a first predetermined maximum for all angles of tilt; and

(ii) the difference in flow rate between the aperture having maximum liquid flow and the aperture having minimum liquid flow in the or each secondary distributor 10 at each angle of tilt is less than a second predetermined maximum for all angles of tilt,

said first and second predetermined maxima being determined by the required degree of liquid-vapour separation; and

at least one of the primary distribution zone and the or each secondary distributor is at least partially filled with packing.

2 Original

The apparatus of Claim 1 wherein the liquid distributor 24 provides uniform or substantially uniform liquid flux per element.

3 Original

The apparatus of Claim 1 wherein the characteristic length (ℓ_c)

is calculated according to the following equation:

$$\frac{Q_{i-j}}{Q_{ave}} = A.C_D\left(\sqrt{\frac{2.\delta\rho}{\rho}}\right)\left(\sqrt{h_i} - \sqrt{h_i - l_c.\sin\theta}\right)$$

where Q_{i-j} = difference in volumetric flow rate between apertures i & j;

Q_{ave} =average flow through the apertures;

A = cross-sectional area of aperture;

C_D = aperture discharge coefficient;

$\delta\rho$ = difference between liquid and vapour density;

ρ = liquid density; and

h = height of liquid above aperture.

θ = angle of distributor tilt.

4 Original The apparatus of Claim 1 wherein the total cross-sectional area of said primary distribution zone 18 defined by the outer periphery thereof is less than the corresponding total cross-sectional area of the secondary distributor(s) 10.

5 Original The apparatus of Claim 1 wherein the diameter of the column 22 is no more than the characteristic length, said liquid distributor 24 comprising one secondary distributor 10.

6 Original The apparatus of Claim 1 wherein the diameter of the column 22 is more than the characteristic length, said liquid distributor 24 comprising a plurality of secondary distributors 10.

7 Original The apparatus of Claim 1 wherein the column 22 is packed in a plurality of sections 32 and the liquid distributor 24 has a separate secondary distributor 10 provided for distributing fluid to each section 32.

8 Presently Amended

The apparatus of Claim 7 wherein the interrelationship between the arrangement of ~~the or~~ each secondary distributor 10 and the arrangement of the plurality of column sections 32 is such that the uniformity of liquid flux per element is increased relative to that for apparatus not characterised by features (i) and (ii) defined in Claim 1.

9 Original

The apparatus of Claim 1 wherein the column is packed in a plurality of sections 32 and the or each secondary distributor 10 is provided to distribute fluid to more than one section 32.

10 Original

The apparatus of Claim 1 wherein the liquid distributor 24 comprises a plurality of secondary distributors 10 in an arrangement having a core secondary distributor surrounded by at least one ring of secondary distributors, said ring being concentric with the core secondary distributor.

11 Original

The apparatus Claim 1 wherein the liquid distributor 24 comprises a plurality of secondary distributors 10 in a "chess board" arrangement.

12 Cancelled

~~The apparatus of Claim 1 wherein the primary distribution zone 18 is at least partially filled with packing.~~

13 Cancelled

~~The apparatus of Claim 1 wherein the or each secondary distributor 10 is at least partially filled with packing.~~

14 Original

The apparatus of Claim 1 wherein the liquid distribution apertures 36 are arranged in a plurality of lines, the or each secondary distributor 10 further comprising at least one liquid flow divider 34 between at least some of said lines.

15 Original

The apparatus of Claim 1 wherein the or each secondary distributor 10 has a base having a thickness that is greater than the

diameter of each liquid distribution aperture 36.

16 Presently Amended — The apparatus of Claim <u>15</u> ~~16~~ wherein the thickness of the base is at least twice the diameter of each liquid distribution aperture 36.

17 Original — The apparatus of Claim 1 wherein the or at least one secondary distributor 10 is divided into two or more compartments 26, each compartment 26 being in fluid communication with each other compartment 26 within said secondary distributor 10.

18 Original — The apparatus of Claim 17 wherein the secondary distributor 10 is substantially circular having a number of sectors, each sector being a compartment 26.

19 Original — The apparatus of Claim 1 wherein the column 22 is packed in sectors 32 about the longitudinal axis of the column, each sector 32 comprising a plurality of vertical sheets of structured packing arranged in parallel in tangential planes to the column axis and the liquid distribution apertures 36 are arranged in a plurality of rectilinear lines extending radially from the column axis, said lines traversing the planes of said packing sheets.

20 Original — The apparatus of Claim 1 wherein the primary distribution zone comprises one primary distributor 18, the or each secondary distributor 10 being fed from the primary distributor 18 via a plurality of openings 42 in the base 40 of the primary distributor 18, said openings 42 being evenly distributed in a region of the primary distributor base 40.

21 Original — The apparatus of Claim 20 wherein the primary distributor 18 is located outside the column.

22 Original — The apparatus of Claim 1 wherein the total cross sectional area

of the secondary distributor(s) 10 is from 60% to 95% of the total cross sectional area of the column 22 with the remaining area being substantially taken up by vapour vents.

23 Original — The apparatus of Claim 22 wherein the total cross sectional area of the secondary distributor(s) 10 is about 90% of the cross sectional area of the column 22 with the remaining area being substantially taken up by vapour vents.

24 Original — The apparatus of Claim 1 wherein the liquid distributor 24 comprises one secondary distributor 10, said secondary distributor 10 being an integral part of the primary distribution zone 18.

25 Original — The apparatus of Claim 1 adapted and/or constructed for cryogenic distillation.

26 Original — The apparatus of Claim 1 further comprising a liquid re-distributor 52 provided at an intermediate location in the liquid-vapour separation column 22, said liquid re-distributor 52 having the features of the liquid distributor defined in Claim 1.

27 Original — The apparatus of Claim 26 wherein the liquid re-distributor 52 comprises the same features as the liquid distributor 24.

28 Presently Amended — A closed system liquid distributor 24 for use in liquid-vapour separation processes, said liquid distributor 24 comprising a primary distributor zone 18 and at least one secondary distributor 10, said primary distributor zone 18 being in fluid communication with the or each secondary distributor 10 and the or each secondary distributor 10 having a plurality of liquid distribution apertures 36, wherein:
~~said liquid distributor 24 being characterised in that~~
the total cross sectional area of said primary distributor zone 18 defined by the outer periphery thereof is less than the corresponding

cross sectional area of the or each secondary distributor 10; and

at least one of the primary distribution zone and the or each secondary distributor is at least partially filled with packing.

29 Presently Amended

An off-shore floating tiltable platform comprising apparatus that comprises, in fluid communication, a closed system liquid distributor 24 and a liquid-vapour separation column 22, said liquid distributor 24 comprising a primary distribution zone 18 and at least one secondary distributor 10, said primary distribution zone 18 being in fluid communication with the or each secondary distributor 10 and the or each secondary distributor 10 has a plurality of liquid distribution apertures 36 providing said fluid communication between the liquid distributor 24 and the column 22, wherein ~~said platform being characterised in that~~:

(i) the distance between the two apertures that are furthest apart in the or each secondary distributor (the "characteristic length") is such that the liquid distributor provides, at each angle of tilt, a standard deviation of liquid flow rates through the apertures of the or each secondary distributor that is less than a first predetermined maximum for all angles of tilt; and

(ii) the difference in flow rate between the aperture having maximum liquid flow and the aperture having minimum liquid flow in the or each secondary distributor at each angle of tilt is less than a second predetermined maximum for all angles of tilt,

said first and second predetermined maxima being determined by the required degree of liquid-vapour separation; and

at least one of the primary distribution zone and the or each secondary distributor is at least partially filled with packing.

30 Presently Amended

Use of apparatus comprising, in fluid communication, a closed system liquid distributor 24 and a liquid-vapour separation column 22 tiltable from the vertical, said liquid distributor 24 comprising a primary distribution zone 18 and at least one secondary distributor 10, said

primary distribution zone 18 being in fluid communication with the or each secondary distributor 10 and the or each secondary distributor 10 having a plurality of liquid distribution apertures 36 providing said fluid communication between the liquid distributor 24 and the column 22, wherein ~~said apparatus being characterised in that~~:

(i) the distance between the two apertures that are furthest apart in the or each secondary distributor 10 (the "characteristic length") is such that the liquid distributor 24 provides, at each angle of tilt, a standard deviation of liquid flow rates through the apertures of the or each secondary distributor 10 that is less than a first predetermined maximum for all angles of tilt; and

(ii) the difference in flow rate between the aperture having maximum liquid flow and the aperture having minimum liquid flow in the or each secondary distributor 10 at each angle of tilt is less than a second predetermined maximum for all angles of tilt,

said first and second predetermined maxima being determined by the required degree of liquid-vapour separation; and

at least one of the primary distribution zone and the or each secondary distributor is at least partially filled with packing to provide uniform or substantially uniform liquid flux per element.

31 Newly Presented

A method of producing a liquid distributor for use off shore in combination with a vapour liquid separation column for a vapour liquid separation, said distributor to comprise a primary distribution zone 18 and at least one secondary distributor 10, said primary distribution zone 18 to be in fluid flow communication with the or each secondary distributor 10 and the or each secondary distributor 10 to have an arrangement of a plurality of liquid distribution apertures 36;
said method comprising:

determining the thermodynamic difficulty of said vapour liquid separation;

determining a first pre-determined maximum standard deviation of flow rates through the apertures of the or each secondary distributor

10 for all angles of tilt to achieve said vapour liquid separation;

determining a second pre-determined maximum difference in flow rate between the aperture to have maximum flow and the aperture to have minimum flow in the or each secondary distributor for all angles of tilt to achieve said vapour liquid separation;

calculating the maximum distance (the "characteristic length") between the two apertures to be located furthest apart in the or each secondary distributor such that the distributor provides, at each angle of tilt,

(i) a standard deviation of flow rates through the apertures of the or each secondary distributor that is less than the first pre-determined maximum for all angles of tilt; and

(ii) a difference in flow rate between the aperture to have maximum liquid flow and the aperture to have minimum liquid flow in the or each secondary distributor that is less than the second pre-determined maximum for all angles of tilt;

preparing a design of a liquid distribution having the characteristic length; and

manufacturing the liquid distributor to the design.

32 Newly Presented

The method according to Claim 31 further comprising tailoring the arrangement of liquid distribution apertures in the or each secondary distributor to co-operate with an arrangement of structured packing in a vapour liquid separation column.